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POPULAR AND PRACTICAL ENTOMOLOGY

THE HOST SELECTION PRINCIPLE AS ADVANCED BY WALSH*

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Shortly after the publication of the results of certain experiments[1] on the host plants by several cerambycid beetles, the writer received a letter from Dr. Nathan Banks calling his attention to two very important papers by Walsh[2,3] in 1864 and 1865. Unfortunately, these papers were entirely overlooked. That Dr. Walsh fully appreciated the extent to which many species, or better, his "phytophagic species" are restricted to a certain plant is fully attested by his statements, which are quoted. In fact, he is probably the first entomologist to state definitely this principle in concise wording. The following quotation is taken from page 405-406-407, Volume III.

"Even with the little we know of the Laws of Inheritance, we might infer a *priori*, that when from peculiar circumstances a Phytophagic Variety, including both the sexes, has fed for a great many generations upon one particular plant of the number inhabited by the species to which it belongs, it would be likely to transmit to its descendants in the imago state a tendency to select that particular plant upon which to deposit its eggs. We know, for example, that young pointer puppies, when taken into the field, will frequently point game without any instruction or training whatever, though the habit of pointing is clearly an acquired and not a natural habit, and must have been transmitted to them from their ancestors in virtue of the Laws of Inheritance. If, then, it should so happen that, owing to the presence of but a single species of the plants ordinarily fed upon by a particular species of insects, or to other causes, eggs have been uniformly deposited by a Phytophagic Variety upon the same plant for an indefinitely long series of generations—say fifty, or a hundred, or a thousand, or ten thousand—and the female has in no case intercrossed with a male belonging to a different Phytophagic Variety, then it is probable that habit will have become a second nature, and that it will cease to be possible for that insect, which by the supposition has fed upon that one plant for a very long series of years, to feed upon any other plant than that to which it has become habituated by the Laws of Inheritance.

"But before this point is reached, another series of phenomena will have come into play. Every naturalist is aware that species often run into what are known as geographical races, when separated into two or more distinct groups

*—Contribution from the Division of Forest Insects, Entomological Branch, Dept. of Agric., Ottawa.

1—Hopkins Host-Selection Principle as Related to Certain Cerambycid Beetles, Journ. Agr. Research Vol. XXII No. 4, pp. 189-220, Oct. 22, 1922.

2—On Phytophagic Varieties and Phytophagic Species by B. D. Walsh, Proc. of the Ent. Soc. of Philadelphia, Vol. III. 1864, page 403-430.

3—Same title and publication Vol. IV 1865, p. 194-216.

by physical barriers. Just so the Phytophagic Variety, having by the supposition been isolated from the other members of its species, will often run into what may be called Phytophagic Races, and finally, perhaps, acquire either a moral indisposition, or a physical inability, to intercross with the other members of the species. It will then have become what I propose to call a Phytophagic Species, distinguished from the other members of the species to which it originally belonged by certain slight peculiarities of size, or of coloration, or occasionally even of structure, just as geographical races are so distinguished. But there will be this essential difference between the two cases: Geographical Races are connected, or supposed to be connected, by all the intermediate grades, and may therefore be reasonably concluded to intercross on the confines of their geographical boundaries. Phytophagic Species are not so connected, and by the supposition they do not intercross, or, at all events, only in very rare instances, as is sometimes the case with what are allowed on all hands to be distinct species.

"According to my views, Phytophagic Species are as truly distinct species as those which differ by much stronger characters. 'The only valid practical criterion,' as I have already said, (Proc. Ent. Soc. Phil. II, p. 220) of specific distinctness is the general non-existence, either actually ascertained or analogically inferred, of intermediate grades in the distinctive characters, whence we may reasonably conclude that the two supposed species are distinct, i. e., that they do not now in general mix sexually together, or if geographically separated, that they would not do so, supposing them to be placed in juxtaposition."

He has further substantiated his remarks by experiments on several species and many careful observations in nature.

It will be seen from the following quotation how similar are the results to those which the writer expresses in 1921.

"Hence, we may conclude, first, that *tessellaris* may, without very material injury to its health, be shifted on to Oak from the other trees on which it naturally feeds; for although, of those that were retained on oak, a much larger percentage spun up than of those that were shifted on to oak from other trees, yet a considerable percentage of the former, and none whatever of the latter, died in confinement. Second. That sycamore is not a congenial food for *tessellaris*; for a considerable percentage of those fed on sycamore died in confinement, and but a small percentage spun up. Third. That oak is abhorrent to *Harrisii* as a food plant. It may seem strange at the first view, that *tessellaris* can be compelled to feed upon sycamore up to the time of its assuming the pupa state, and *Harrisii* cannot be compelled to feed for any length of time upon oak; but when we consider that in a state of nature the former is polyphagous and the latter monophagous, our surprise will cease. It is not that *Harrisii* does not eat the oak-leaves furnished to it—for the quantity of excrement on the floor of the breeding-cage at each shifting and cleaning out proved that it must eat them—but that, having eaten them, it either perishes of disease superinduced by the unnatural food, or bores its way out in despair through the millinet of the cage, or devours its own brethren in default of its natural food-plant.

"It will be observed from the table that in Nos. 5, 6, and 7 the average

number of days when the larvae were found missing is small, being only a little over four days; whereas in Nos. 3 and 4 it is large, being a little over sixteen and a half days. The reason of this difference is, that in the former, as soon as the larvae were placed on the leaves they commenced endeavouring to escape; whereas in the latter, they mostly stayed contentedly on the leaves until they were full-grown, when many escaped from the breeding-cage, probably in search of a more convenient place in which to spin up."

On page 411, Vol III, he writes as follows: "That there may be no mistake, it may be as well to say here that the difference between what I call a Phytophagic Variety and what I call a Phytophagic Species is simply this: The former habitually intercross with the normal race, the latter do not." In this connection the writer called attention (former citation) to the fact that several species in his experiments, after having bred in the same wood for two or three years, did not copulate as readily with other host strains as did those from the same plant.

In this same paper are some words of consolation to those who are working on the larval stages of insects and find many striking anomalies between the present adult classification and those suggested by larval characters. Dr. Walsh writes: "No entomologist hesitates to consider two imagos as distinct species, merely because the larvae are undistinguishable. In many families, indeed, e. g. *Cynipidae, Apidae* and *Muscidae,* very many larvae bear so close a resemblance to each other that he would be a bold man who pretended to distinguish them. Why then refuse to consider two well characterized larvae, like *tessellaris* and *Harrisii,* as distinct species, merely because their imagos are undistinguishable? Why lay all the stress upon the characters of the imago, and none at all upon those of the larva or pupa? This is as irrational, as if an entomologist were to cut off and throw away the wings and legs of every imago which he is studying, and persist in classifying it from the consideration of its body alone; much in the same way as conchologists used formerly to neglect and undervalue all the soft parts of Mollusk, and decide on its systematic affinities only from the characters of its shell.

"On the general principle that, whenever two insects differ by constant and well-marked characters in any of their states, whether egg, larva, pupa or imago, they must be specially distinct, unless they be the sexes of other dimorphous forms of one and the same species, the case of *tessellaris* and *Harrisii* might be rested here."

Walsh's discussion of *Cyllene pictus* and *C. robiniae* were particularly interesting to me as a coleopterist studying the larvae. No one now hesitates to pronounce these two insects, the one from hickory and also many other plants, the other only from black locust, as distinct species, in fact the larvae are easily separated, more readily perhaps than the adults. Walsh points out remarkable difference between the larvae of *C. robiniae* and *pictus*—the latter furnished him by Osten Sacken. Unfortunately, this was not the larvae of *Cyllene pictus,* but very likely that of *Xylotrechus colonus.* Although Walsh was probably not so familiar with the anatomical structures of these larvae as we know them today, his keen power of observation and deduction are well illustrated by his skepticism as to the identity of the larvae from Osten Sacken. On page 204, Vol IV, he

says, "Can it be possible, that of two such closely allied species as *robiniae* and *pictus*, one is apod in the larval state and the other has distinct feet?" This was from a description of *C. pictus* by Osten Sacken, before receiving the larvae from him. After examining the actual specimen, in a footnote, page 205, Vol. III, he further comments on the remarkable differences, and though apparently accepting the facts as supported by the specimens, does so very dubiously, stating, "On the whole, I am inclined to believe the larvae of *C. pictus* is really apod, and that of *C. robiniae* really six-footed; but as this is so remarkable an anomaly, it would be very desirable to verify the facts by further observations."

These larval comments are somewhat off the subject of this article, yet I thought it worth while to mention them as an example of his keen power of observation. When we consider how little has been known of the characters of the Cerambycid larvae, Walsh's comments are all the more remarkable. As recently as 1912 Webb[4] confused *Cyllene pictus* and *Xylotrechus colonus* larvae. This can easily occur, since both feed in the same logs. *Cyllene pictus* pupates and transforms to adult in the late summer, all the brood transforming about the same time while *X. colonus* larvae all overwinter as larvae except a few, which emerge as beetles in the late summer. Consequently, it is a simple matter to collect pupae or adults of *C. pictus* and associate the larvae of *X. colonus* in the same wood with them.

Space hardly permits me to comment on these papers as fully as I would like, as there is a certain pleasure in finding one's own observations so completely verified, even though antedated. In fact, practically all the conclusions to which the writer arrived after a rather lengthy series of experiments have been expressed some fifty years previously by Dr. Walsh.

THE DATA OF ENTOMOLOGY

BY T. D. A. COCKERELL,

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It is a curious fact that artists, some of them highly competent and distinguished, will not rarely paint quite impossible butterflies while the flowers or human figures in the same pictures are well and accurately drawn. Zoologists, whose discussions of animals are conscientiously precise, will misquote and misspell the names of plants. Entomologists, whose morphological studies command our admiration and respect, will be careless and inaccurate in citing localities. Thus we find that the training acquired in a narrow field is not necessarily carried over to or effective in fields which are closely adjacent. The truth of the matter seems to be, not so much that the training *cannot* be made effective elsewhere, as that it *is* not made to function through *lack of interest*. Thus, the old debate concerning the value of the classics has often missed the real point. No doubt a sound classical education develops the powers of the mind: but we have to complain of the classically educated, because they so often remain ignorant of and indifferent to other matters of serious importance. It

4—Webb, J. L. A Preliminary Synopsis of Cerambycoid Larvae. Tech. Series No. 20, Part v, U. S. D. A. 1912.

is of no avail that they might do things, so long as they will not. The immediate cause of these remarks is the receipt of the misnamed "Insecutor Inscitiæ Menstruus" for July-September, 1922, containing a description of the new species, *Chilosia sonoriana* Shannon, said to be from Las Vegas, New Mexico, 11,000 ft. altitude. The altitude given is not that of Las Vegas, and the specimens came from the Las Vegas Range, as the label surely stated. The specific name is inappropriate for an insect which inhabits the Hudsonian Zone. It seems worth while to present a few other corrections, as later on it will be difficult to eradicate the errors from the literature. It ought to be said that errors of this type are not infrequently due to preparators rather than authors. I could cite rather numerous cases of misspelled or other erroneous printed labels, placed on whole series of specimens in museums.

Apantcles cockerelli Muesebeck, 1920. Cited from "New Mexico"; the precise locality was Mesilla. I am afraid I was to blame here, as in my earlier collecting I used numbers, and failed to put the proper data on the labels.

Prosopis rudbeckiae granulatus Metz, 1911. No locality given. The specimens are in American Museum of Natural History; three are from Ormsby County, Nevada (*Baker*), which I will now designate as the type locality. One is from Woods Creek, Kings River Canyon, California, 8,000 ft., June 16, 1910 (*Metz*).

Zagrammosoma americana Girault, 1916. "Boulder, Col. (Cockerell)." It was probably collected by Bethel, and from southern Colorado.

Agromyza indecisa Malloch, 1913. "Las Vegas, 11,000 ft." Should be Las Vegas Range.

Agromyza minima Malloch, 1913. "Mescalero, Mexico." Should be New Mexico.

Incurvaria sedella Busck, 1915. "Boulder." Should be Boulder Canyon.

As our data become more complete, the significance of additional records can be better appreciated. If authors would endeavor to present the facts in relation to others, their papers would be more interesting. Thus, I have just identified a female of *Malissodes suffusa* Cresson, overlooked in my boxes, which I collected at Socarro, New Mexico, at flowers of a species of Compositae, June 29, 1895. I noted that it was hard to catch. This information, as it stands, is of little interest, but we may add the following: *M. suffusa* is a well-known species of Texas, extending to Lower California. It has been taken at Flagstaff, Arizona, where it seemed far out of its range, especially as many years of collecting had apparently revealed no trace of it in New Mexico. Now it proves that it does occur rarely in New Mexico, visiting Compositae as in Texas. The Socarro specimen is narrower and less robust than one from Texas. Thus the significance of the new record appears, and the reader is left with a question in his mind: Why is the insect so wide spread in New Mexico and Arizona, and yet so scarce there? Is it invading that part of the country, or is it an old inhabitant, now on the wane?

THE DISTRIBUTION AND FORMS OF LYGAEUS KALMII STAL, WITH REMARKS ON INSECT ZOOGEOGRAPHY (HEMIPTERA, LYGAEIDAE)[1]

BY H. M. PARSHLEY,
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For several years I have been interested in gathering data on the distribution of *Lygaeus kalmii* Stal, a Lygaeid which occurs commonly throughout the greater part of the North American continent. Examination of the materials contained in the United States National Museum, the Canadian National Collection at Ottawa, and many other institutional and private collections has afforded a very extensive set of records, now grown sufficient, I think, to warrant detailed presentation. The study of this body of data throws light on several questions, which may be introduced by a brief review of the taxonomic history of the species.

In connection with his original description[2] of *L. kalmii*, Stal distinguished three color varieties, *a*, *b*, and *c*, based on the varying development of the red pronotal fascia and of the white membranal spots, to which Montandon[3] added a fourth, the melanic var. *melanodermus*. Uhler,[4] discussing *kalmii* (by inference) and related species, advanced the idea that contrary to Montandon's views these forms should be united under the name *turcicus* Fabr., but subsequent investigation has not shown this contention to be well founded; variation is not, as Uhler thought, continuous between them. The next event in this history was the subdivision of *L. kalmii* into two subspecies, which I was led to propose[5] after a study of newly acquired data. I restricted the name *kalmii* to the western race (which includes Stal's vars. *a* and *b*) and suggested the name *angustomarginatus* for the eastern form (which includes Stal's var. *c*). Finally, in my friend, H. G. Barber's, excellent revision of the genus Lygaeus,[6] the specific standing of *kalmii* is maintained and my subspecific arrangement is recognized.

Before considering the zoogeographical data referred to above, we must discuss briefly the status of the numerous color variations which are to be observed in any extensive series of *kalmii*, from any locality, only a few of which were singled out for attention by Stal and Montandon. Study of a very large amount of material shows clearly, I think, that no varietal forms worth naming can be established upon these color characters—variations in the red pronotal band and the membranal spots (Stal) or in degree of darkness in general pigmentation (Montandon). All of these criteria exhibit infinitesimal intergradation, even in material from a single locality, and the supposed melanism is, to judge from my experience, largely if not wholly due to post mortem discoloration.

The two subspecies or geographical races of *L. kalmii* are so clearly distinguishable in habitus that the experienced student needs no locality label to tell whether any given specimen is of eastern or of western origin (except for

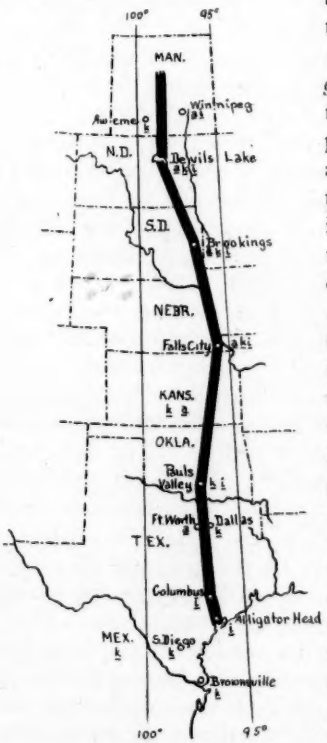
1—Contributions from the Department of Zoology, Smith College, No. 100.
2—Enum. Hem. 4: 167, 1874.
3—Lyg. exot., Ann. Soc. Ent. Belgique, XXXVII: 400, 1893.
4—Obs. Het. Hem. L. Calif., Proc. California Ac. Sci., (2) IV: 246, 1894.
5—Hem. Western Canada., Occas. papers Mus. Zool. Univ. Michigan, No. 71: 14, 1919.
6—Proc. Biol. Soc. Washington, XXIII: 63-68, 1921 (Treats only the American species).

the very rare intermediates to be discussed presently). This divergence is due to the combined effect of a number of characters, of which the chief may be tabulated as follows:

Membrane with two usually large discal white spots, and with a broad, white margin; the red band between corium and membrane strongly narrowed at middle; dorsal dark areas grayish black (western) ... subsp. *kalmii* Stal, typ.

Membrane usually without spots, rarely with small ones, the white margin extremely narrow or absent; red band not so strongly narrowed; dark areas nearly or quite dead black (eastern) .... subsp. *angustomarginatus* Parsh.

The distribution of *L. kalmii* is shown by provinces and states in the accompanying table. It will be noted that the two subspecies occupy distinct territory, except for the area in which their ranges meet, and since it is this intermediate region which has greatest interest for us, I have prepared a map of it to show graphically and in detail the facts disclosed by my study of the records. Three points are emphasized: (1) the most eastern occurrences of *L. k. kalmii*; (2) the most western occurrences of *L. k. angustomarginatus;* (3) occurrences of all known intermediate individuals. When these three are plotted it is at once seen that they lie on or near a north and south line running between the 95th the 100th meridians from Canada to Texas. This is indicated on the map by the heavy line, which thus represents conventionally the very narrow common territory of the two subspecies, the only area where, according to present knowledge, there are influences at work tending to produce individuals of intergradational type. What these influences are cannot be deduced with certainty from the data, but it seems reasonable to suppose that they are either environmental or genetic.



Map showing where the subspecies of *Lygaeus kalmii* meet. *a*, extreme western records of subsp. *angustomarginatus*; *k*, extreme eastern records of subsp. *kalmii*; *i*, records of individuals of intermediate character.

The environmental factors are yet to be worked out in detail, but some light is thrown on the question in a general way by a consideration of the physiographic character of the region. Comparison of our map with that accompanying Fenneman's work[8] on the physiographic divisions of the United States shows that the line of contact between the subspecies of *kalmii* corresponds, almost coincides, with the line which separates two physiographic provinces, the Central Lowland and the Great Plains, which are rather strongly contrasted in character. This correspondence I take to be very significant, and, depending upon it, I venture to predict that the two

8—Ann. Assoc. Am. Geog., VI: 19-98, 1917.

subspecies will prove to be separated by the Smoky Hills in Kansas, from which state I have at present no definitely localized records. Throughout much of the intermediate region, however, the transition is rather gradual in character, which may in some way account for the intergrading of the subspecies, as often happens, we are given to understand, in the case of vertebrates; but it seems to me to be at least equally probable that interbreeding would produce the same result. If we accept the reasonable assumption that the characters of the subspecies are dependent on multiple genetic factors, then we would expect to find graded intermediate series among offspring, in places where individuals of the two races occasionally meet and reproduce. This, the evidence tends to show, must happen but rarely, or intergrades would be more numerous in collections. If *kalmii* and *angustomarginatus* are incipient species, we may suppose that psychological or even anatomical barriers to intercourse have begun to rise between them.

TABLE SHOWING THE DISTRIBUTION OF LYGAEUS KALMII[7]

L. k. kalmii	Both subspecies	
Alberta	*Manitoba	New York
Saskatchewan	*North Dakota	New Jersey
Manitoba	*South Dakota	Pennsylvania
British Columbia	*Nebraska	Maryland
Washington	Kansas	District of Columbia
Idaho	*Texas	Virginia
North Dakota		North Carolina
South Dakota		Georgia
Oregon	L. k. angustomarginatus	Florida (?)
Wyoming		North Dakota
Nebraska		South Dakota
California	Nova Scotia	Wisconsin
Nevada	Quebec	Michigan
Utah	Ontario	Nebraska
Colorado	Manitoba	Iowa
Kansas	Maine	Illinois
Arizona	New Hampshire	Ohio
New Mexico	Vermont	Kansas
*Oklahoma	Massachusetts	Missouri
Texas	Rhode Island	Texas
Mexico	Connecticut	Mississippi

The intermediate individuals (whose occurrence is designated on the map by *i*) are diverse, some tending toward the western type, some toward the eastern. We may indicate their general nature by the description of several, bearing in mind that they all *look* intermediate. The Manitoba specimen has rather small membranal spots, a margin of intermediate width, and red bands of the western type. Several from North Dakota (kindly provided by Mr. R. F. Hussey) exhibit gradation in the white markings and in the grayness of the surface but have red bands of the western character. The South Dakota indi-

7—The asterisk (*) indicates the occurrence of intermediates.

vidual is similar, but has the white markings much reduced. An Oklahoma specimen has a very narrow membranal margin, but is otherwise almost typically western, while one from Columbus, Texas, is similar but lacks the white spots entirely.

This study brings to mind certain matters which may be lightly touched upon in conclusion. In the first place, it emphasizes again the importance of detailed faunistic work. It used to be the fashion to deride local lists and those who wrote and published them, but styles change and it is now clear to almost everyone that it is just this sort of work (granted the taxonomic foundation) which is most necessary for progress in zoogeography—just this which is almost always found to be insufficient or totally lacking when the distribution of a single species is undertaken as an object of study. Moreover, it is not enough to present a list of accurately identified species; detailed locality records of infraspecific forms must also be given. Here is implied the best argument for the naming of varieties, *i. e.*, recognizable forms of less than specific value, intergrading and interbreeding (at least inferentially) with the typical form of the species, and not known to be separated geographically. If such forms are not described and named (under the noncommittal designation *variety*) there is little likelihood that sufficient data pertaining to them will ever be accumulated to show whether or not they belong in reality to the important category designated synonymously as subspecies, geographical race, or incipent species. In this connection I note with interest some observations in the latest paper of Mr. Morgan Hebard[9], one of the few entomologists whose distributional work can be considered adequate from our present point of view. A brief quotation from his article will serve to point my investigation of *Lygaeus kalmii*. Discussing the two races of *Radinotatum brevipenne*, a Floridian locust, he says: ". . . . . an area of intergradation lies between the geographic races of a species, unless the latter be insular or has in some other manner been completely separated from the parent stock. . . . . Both races are individually variable, but any series from southern Florida may be easily separated from any series from the northern portion of the species' range." The definitions and concepts (regarding the subspecies especially) which I am emphasizing in this report may seem commonplace or even platitudinous to the student of vertebrate distribution, but they are certainly not so in the field of entomology; there are even recent papers on insects in which the terms *subspecies* and *variety* are used interchangeably, and in the highly developed subject of myrmecology the word subspecies has, I believe, a peculiar connotation. It is a matter of the greatest biological interest to observe phenomena which are identical in vertebrates and in insects, both so far advanced along widely divergent paths of evolution, and it would seem highly desirable to maintain in such cases a similarly identical terminology.

9—N. Am. Acrididae, Achuri, Trans. Am. Ent. Soc., XLVIII: 89-102, 1922.

NOTES ON PTEROPHORIDAE WITH DESCRIPTIONS OF NEW SPECIES*

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Pterophorus (Oxyptilus) cygnus B. & L.

In working over the material in the Canadian National Collection of the genus *Pterophorus* in the light of Dr. Lindsey's revision (Barnes & Lindsey, Cont. Nat. Hist Lep. N. Am. IV (4) pp. 297—308) I was surprised to find that all the specimens under the name *tenuidactylus* Fitch were referable, according to genitalia, to *cygnus* B. & L. This species was described from a single ♂ specimen from Iowa City, Iowa, and, apart from genitalia, was diagnosed as differing from true *tenuidactylus* by the presence of white markings on the fourth abdominal segment. While there is no doubt about the agreement of the genitalic slides of our Canadian specimens with Lindsey's figures of *cygnus*, (Pl. XLIX, fig. 2), they certainly do not fit in with the above diagnosis, but appear to have the same abdominal markings as those ascribed to *tenuidactylus*, that is to say, oblique white stripes on the third abdominal segment meeting in the centro-dorsal line to form an inverted V mark, a brown fourth segment, and a fifth segment which is largly white; this latter is especially the case with the females, of which there are six very perfect specimens from Ottawa before me. Through the kindness of Dr. Wm. Barnes I have had the opportunity of examining a series of specimens of *tenuidactylus* from his collection, as determined by Dr. Lindsey; the series includes three males and the genitalia of these (examined *in situ*) agree both with our own specimens and with Lindsey's fig. 2 (*cygnus*); the maculation is also similar. Under the circumstances it would seem that there had been a mix-up of slide material and that fig. 2 (Pl. XLIX) really refers to *tenuidactylus*, which would bring it into line with Fernald's monograph. Whether fig. 1 of the same plate should be referred to *cygnus*, in place of *tenuidactylus*, can only be decided when more material from the type locality of the former species is available for study.

Pterophorus evansi n. sp.

Palpi slightly shorter than those of the preceding species. Primaries very similar in colour and maculation but the brown somewhat duller and the second lobe slightly narrower and with less excavated outer margin. Third lobe of secondaries with less distinct white median area preceding black tuft than in *tenuidactylus*, this area being suffused with brown scaling. Hind legs with median pair of spurs just beyond middle of the tibia (differs from *ningoris* in this respect) and with both a dorsal and an outer lateral brown longitudinal stripe, whereas in *tenuidactylus* only the lateral stripe is present. The abdominal markings are quite distinct from those mentioned above for *tenuidactylus*; there is no markedly white segment except the first and the remainder of the abdomen is brown with white oblique, inverted V-shaped, dorsal lines and a lateral white line in the stigmatal region above the flange; beneath largely white

*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

with brown longitudinal lines. In general the species is closest to *raptor* Meyr., but differs in the position of the median spurs of the hind tibiae. The genitalia are quite distinct from those of any of the described species; the ventral plate is similar to that of *ningoris* as figured by Lindsey (l. c. Pl. XLIX, fig. 6) but the distal prongs are longer; the clasper is of more or less even width throughout its entire length, the apex being truncate with the ventral edge produced downward into a blunt point, giving somewhat the appearance of a bird's bill; in this respect it resembles Lindsey's figure of *periscelidactylus,* the produced portion, however, being shorter and broader. Expanse 14 mm.

Holotype—1 ♂, Trenton, Ont. (July 18, '11) (J. D. Evans); No. 556, in the Canadian National Collection.

Allotype—1 ♀, Trenton, Ont., (July 17, '11) (J. D. Evans); in the Canadian National Collection.

Paratypes—3 ♂, 3 ♀, same locality and collector, taken at various dates in July except a single ♂ which was captured June 4.

I take pleasure in naming this species after one of the pioneer entomologists of Canada, whose collection is now incorporated in the National Collection at Ottawa. A single ♂ is before me from Aweme, Man.; this record extends the distribution of the species considerably westward.

Platyptilia williamsi Grin.

A long series captured by me at Nordegg, Alta. seems referable to *williamsi,* a species which has heretofore been scarcely represented in collections. Specimens came commonly to light in late June and the first half of July and the series before me shows considerable range of variation in brightness of colour and amount of brown shading on first lobe of primaries. A superficial examination of the male claspers shows them to be close to those of *percnodactyla*; in general appearance our specimens run closer to *edwardsi,* from which they are readily separated by the central position of the scale tooth on the third lobe of the secondaries.

Stenoptilia bowmani n. sp.

Primaries dull gray-brown with white scaling as follows:—along the basal portion of costa and at base of wing, a small oval patch above inner margin before middle, a larger oblong rectangular patch in central portion of wing before base of cleft and slight shading on costa above base of cleft; there is a dark spot on inner margin preceding the first white patch and the larger white rectangular patch is preceded by a square blotch and followed by a more or less triangular patch with its base below and parallel to costa and apex just before base of cleft, from which it is separated by a few white scales; a faint white line crosses both lobes parallel and close to outer margin; fringes on outer margin dark inwardly, white outwardly, cut twice by a narrow white scale tuft about centre of each lobe; on the margin of lobe and on inner margin the fringes are mostly white with scattered black scaling. Secondaries dull brown with paler fringes. Thorax and abdomen gray-brown with metathorax scaled with white and with white scales laterally on abdominal segments. Legs dull gray with scarcely noticeable darker bands before spurs on hind tibiae. Expanse 20 mm.

Holotype—1 ♀, Nordegg, Alta. (June 20) (J. McDunnough); No. 559, in Canadian National Collection.

The rather checkered character of the primaries readily separates the species from any of the described forms, and I therefore venture a description based on a single specimen. The species is named after Mr. Kenneth Bowman, of Edmonton, who has been an ardent and successful collector of Lepidoptera in Alberta for a number of years.

Oidaematophorus lindseyi n. sp.

Head brown with a pale band between the antennae, thorax creamy, abdomen pale ochreous with single dark dorsal dot on posterior margin of segments. Primaries ochreous, pale creamy at base and through basal part of cell, lightly sprinkled with black dots, especially along costa, before the cleft and above inner margin near base; lobes only very faintly sprinkled. Secondaries pale smoky. Expanse 27 mm.

Holotype—1 ♂, Aweme, Man. (Aug. 15) (N. Criddle); No. 560, in Canadian National Collection.

Paratype—1 ♂, same locality, date and collector, in Canadian National Collection.

This species was referred by Lindsey in his revision (l. c. p. 392) to *cineraceus* Fish; the genitalia, however, hardly warrant this reference. The harpe in the present species forms a deep basal loop which descends half-way to the base of clasper and is much deeper than in *cineraceus* and in fact than in any of the species figured in the revision; it is closer to *grisescens* in this respect than to *cineraceus;* there is also a distinct difference in the shape and length of the juxta, the outer branch in *lindseyi* being much longer and more pointed. I consider these differences, combined with the general dissimilarity of appearance, to denote specific distinctness. I have seen a third specimen of the same species in Mr. Bowman's collection from Edmonton, Alta.

Oidaematophorus fishi Fern.

Five ♂'s in the Canadian National Collection appear to be referable to this species on genitalic characters. These are from Nordegg, Alta., (Aug. 1) (J. McDunnough), Banff, Alta, (July 28, Aug 3, 22) (C. B. Garrett) and Nicola, B. C., (July 30) (P. N. Vroom). The British Columbia specimen is the palest, the lobes being largely white, whilst two of the Banff specimens are much suffused with dark gray.

Oidaematophorus costatus B. & L.

A single ♂ collected at Nicola, B. C. (July 26) by Mr. P. N. Vroom agrees with *costatus* in genitalic characters. It lacks entirely, however, the gray shades on primaries mentioned in the original description and seems to agree very closely with the diagnosis of *australis* Grin. in general colour of primaries. More material from British Columbia and a knowledge of typical *australis* and *costatus* will be necessary before a definite determination is possible.

THE LIFE HISTORY OF EUPHYLLURA ARBUTI SCHWARZ (HEMIPTERA; CHERMIDAE)

BY G. F. FERRIS AND PERSIS HYATT,
Stanford University, Calif.

At various times during the past few years reports have been received of injury to madrone trees (*Arbutus menziesii*) in the San Francisco Bay region apparently resulting from the activities of a Chermid (Psyllid), *Euphyllura arbuti* Schwarz. The occurrence of this injury, together with the fact that the insect is of itself a very interesting species, has led to the following study. The junior author is responsible for the field notes while the senior author is responsible for the figures, descriptions of the immature stages and the actual preparation of the paper.

It is hoped that this paper may be but the first of a series dealing with the much-neglected immature stages and life histories of representatives of this family.

THE MADRONE CHERMID.

1904. ***Euphyllura arbuti*** **Schwarz, Proc. Ent. Soc. Wash. 6: 237-8; fig. 7.**
1914. ***Euphyllura arbuti*** **Schwarz, Crawford, Bull. U. S. Nat. Mus. 85: 117; fig. 6.**

Hosts and Occurrence. Originally described from specimens taken in Santa Cruz County, Calif., and as far as published records are concerned, apparently known only from this record. It is very abundant on the Santa Cruz Peninsula and has been taken by the junior author in Marin County. Information has been received of its occurrence at Mendocino City in Mendocino County. In all probability it occurs throughout the range of its host, which is from British Columbia to southern California and possibly northern Lower California.

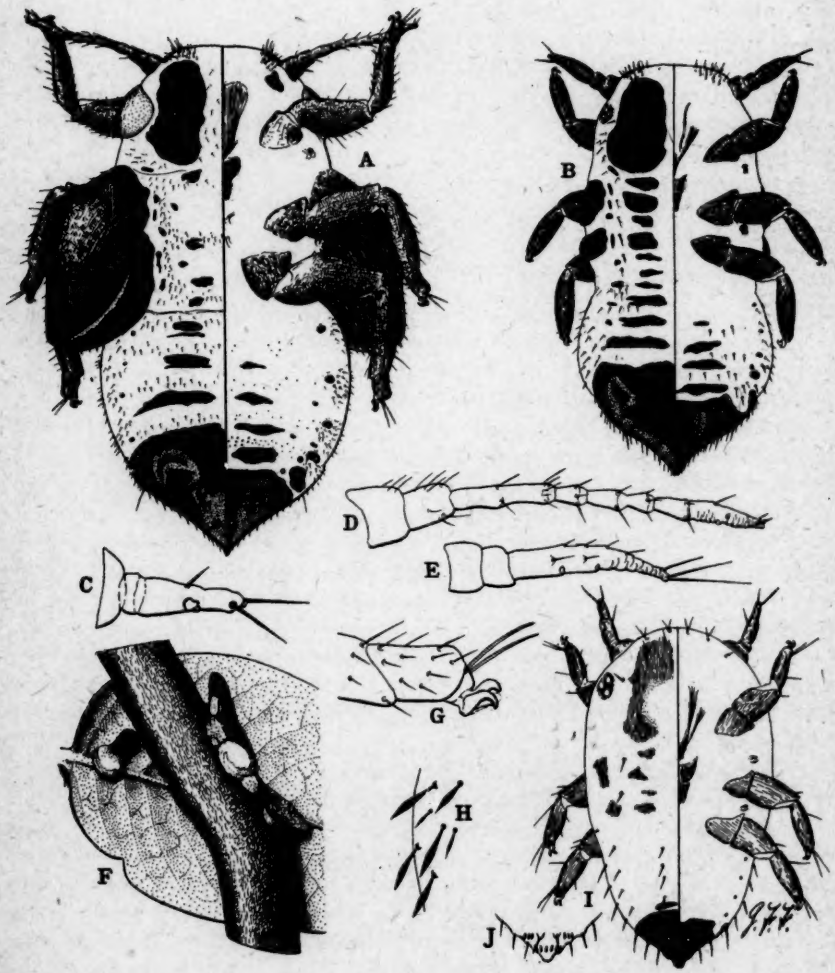
A very similar species occurs on *Arbutus arizonica* in Arizona and the other American representatives of the genus are recorded from members of the related host genus *Arctostaphylos* or *Uva-ursi,* which in California at least are commonly known as "manzanita."

Apparently *Arbutus menziesii* is the only host of *E. arbuti.* It evidently does not transfer to manzanita, for bushes of the latter have been found with their branches intertwined with those of heavily infested madrones, yet free from infestation.

General Habits. The immature stages of this species are especially interesting from the fact that the waxy secretion, which occurs so commonly in members of this family, here takes the form of a cell within which the insect is entirely enclosed until maturity. These cells are composed originally of delicate threads of pure white wax which eventually become fused into an amorphous mass and are frequently blackened with the "sooty mold" which grows in the excrement of the insect. The wax is sticky and soft at first but finally becomes hard and more or less brittle, at least in part.

Most frequently these cells (Plate II, fig. F) are found under bark scales or in other protected situations on all parts of the tree, where they may be thickly crowded together. Not infrequently, however, they occur exposed upon the leaves or the bark. It is evident that the insects "prefer" the protected situations and that the individuals thus protected have a decided advantage over those which are not. During the months of January to March in 1922

Can. Ent. Vol. LV. Plate 2.



EUPHYLLURA ARBUTI SCHWARZ

no living nymphs were found except under the cover of the bark or of new growth.

All of the molts, except the last, take place within the cell and the exuviae are incorporated in the cell walls. As a rule the insect remains within its cell, but if it is disturbed, or if for any reason a change of position is necessary, it does not hesitate to leave the cell and form another.

The final molt, from which the insect emerges as an adult, always takes place outside of the cell, the nymph forcing its way out and crawling a considerable distance, frequently to the under side of a leaf where it may remain exposed for some time before the molt takes place. The fact that the earlier molts take place within the cell makes it difficult to determine their number definitely. Nor is counting the number of exuviae entangled in the cell walls a sure indication of the number of molts, for in some cases it is very evident that the insect has either moved or that some of the exuviae have been lost. In other cases it is equally evident that other wandering nymphs have been caught in the sticky walls of the cell along with the exuviae of its maker. However, it appears that there are in all five molts, and that number is here accepted as correct, the successive stages being described and numbered on this basis.

The Egg and Oviposition. The eggs are placed singly or in clusters at the axils of the stems, on petioles, new leaves, or in the folds of new growth. They are attached by a slender stalk, one end of which is thrust into the tissues of the host, and are elongate with the basal end rounded and the distal end very acute. The egg is about .47 of a millimeter long and the stalk about .5 of a millimeter. The egg is smooth and entirely free from sculpturing.

The females are capable of producing a large number of eggs. One female in the laboratory produced 83, another 203, another 324. A copulating pair was caged in the field and after eleven days 536 eggs were found. The period of incubation varies from 14 to 30 days, depending upon weather conditions.

Eggs have been found at practically all times of the year. In 1921 the first record was for May 13th and they were then observed from time to time during the summer. They were abundant in October and continued to be found through December and into January, 1922. Then very few were seen during February and March, the weather having been—for this region—quite cold. At the end of March a few scattering eggs were found and on April 24th females were seen ovipositing in the field. From that date they appeared in increasing numbers until by the end of May few twigs could be found that did not bear some eggs.

On May 4th a female copulated twice in the laboratory, the copulation lasting in the first case for 80 minutes and in the second for 30 minutes. Until May 9th this female did not move from its first position and then it moved only slightly. On May 12th eggs were found to have been laid during the night. The egg-laying period lasted for three days, a total of 203 eggs being produced.

In the field a female was seen ovipositing on April 29th and she was enclosed in a wire cage which was placed about the twig. After a week she was found to have laid 324 eggs. Another female was found in copulation on May 15th. The twig was free from eggs and a netting was placed about it. On May 20th a few eggs were found and on May 26th the number had increased to 536.

This may not have been the limit of her capacity, for at this point she escaped from the cage.

First Nymphal Stage. The first stage, upon hatching, is oval, light yellow in color, with red eyes, and is approximately .45 mm. long. Upon leaving the egg it crawls a short distance and inserts its proboscis into the host. A protected situation is sought, and so a number of individuals may congregate under a single bark scale or in a similar situation. The secretion of wax begins soon but the insect does not cover itself entirely for a week or more. The first molt occurs after the cell has been formed.

In this stage (Fig. I) the antennae (Fig. C) are short, stout and three-segmented, the first two segments very short, the third elongate, with two rather stout apical setae and a large sensorium at about its middle. The eyes are very small and three-facetted. The legs are quite short and stout, with the tarsal segment very obscure. The dorsum is beset with a pair of large, irregular chitinized areas between the eyes and several small areas on the thorax. The tip of the abdomen is heavily chitinized, both dorsally and ventrally, and bears two rings of pores (Fig. J). Setae are very few, all slender.

Second Stage. (Fig. B). This stage shows several marked differences from the first. The antennae are similar, but the first two segments are larger and the large sensorium is replaced by two small ones. The dorsal chitinized areas on the thorax are larger, more heavily chitinized and more numerous, and two of them are the very evident rudiments of the wing-pads. The chitinized area at the apex of the abdomen is much larger and the pores are arranged in quite definite areas, both dorsally and ventrally. The abdomen, both dorsally and ventrally, bears several pairs of small, chitinized areas. Setae are much more numerous, but retain the same form as in the first stage.

Third Stage. Differing from the second chiefly in the larger size of the wing pads.

Fourth Stage. Differing from the second and third chiefly in the form of the antennae (Fig. E), in which the third segment has become much elongated, and in the still larger size of the wing-pads. The eyes are larger and have a larger number of facets.

Fifth Stage. (Fig. A). Length 2.4 mm. Differing markedly from the preceding stages in the form of the antennae (Fig. D) which are now quite long and slender and seven segmented. The eyes are now large and many facetted. The chitinized areas on the dorsum of the thorax are very much smaller than in the preceding stage and the wing-pads still larger. The setae on the abdomen are for the most part of a lanceolate form (Fig. H). The tarsi (Fig. G) are distinct, one-segmented, and bear a pair of digitules. The pulvilli are very small and inconspicuous, contrasting strongly with the condition seen in some other species, where they are very large and conspicuous. No data are available as to the total duration of the nymphal period.

Adult. A sufficiently good description of this stage is given both by Schwarz and Crawford. The adults are capable of jumping and flying, but they are usually very sluggish when not disturbed. They may sit for hours, or even days, in one position, usually on a leaf petiole, with their heads pointed down and their beaks inserted into the tissues of the host.

Parasites. Three species of Chalcidoid parasites were reared from the nymphs, these being determined by Mr. A. B. Gahan as *Psyllaephagus* sp., *Pachyneuron* sp., and *Alloxysta* sp. These seem to attack chiefly, if not exclusively, the last nymphal stage, and the percentage of parasitism appears to be fairly high.

EXPLANATION OF PLATE 2.

Euphyllura arbuti Schwarz: A.—fifth and last nymphal stage; B.—second nymphal stage; C.—antenna of first nymphal stage; D.—antenna of fifth stage; E.—antenna of fourth stage; F.—nymphal cells on twig and leaf; G.—tarsus of fifth stage; H.—setae from margin of abdomen of fifth stage; I.—first nymphal stage; J.—pores at tip of abdomen of first stage.

STUDIES IN CANADIAN DIPTERA*

I. REVISION OF THE ASILID GENUS CYRTOPOGON AND ALLIED GENERA.

BY C. HOWARD CURRAN,

Ottawa, Ont.

In the series of papers to be published under this heading it is proposed to deal with various groups of Canadian Diptera in a synoptic or monographic manner. It is hoped in this way to gradually assemble a collection of papers which will be of value to students of the Canadian dipterous fauna and perhaps prove an incentive to those who at present find it impossible to determine their specimens. The literature dealing with Canadian Diptera is widely scattered and much of it unavailable, and few keys to the species and genera are available owing to the very large number described in recent years. The author will be pleased to determine specimens for Canadian collectors at any time.

The following paper is based upon material in the Canadian National Collection. Several years ago, Dr. McDunnough, Chief of the Division of Systematic Entomology, commenced the accumulation of specimens of Asilidae, and a fairly complete collection from Canada has been secured. It was found that only a few of the species of *Cyrtopogon* could be definitely determined, but owing to the absence of specimens from the type localities it was not possible to be certain that many of the species were undescribed. Recently, I visited the United States National Museum, Washington, D. C., and the Museum of Comparative Zoology, Cambridge, Mass., and examined the types in these collections, comparing specimens with them. The result has been the description of many new species in the present paper. Where specimens of other American species have been examined they are included in the table of species. Many of them probably occur in Canada.

The genus *Cyrtopogon* was found to be a somewhat complex group, and I have therefore divided it into two genera, based upon the antennal structure and wing venation, and for two species which were previously placed in the genus *Cophura* I have established a new genus, as these species are closely related to *Eucyrtopogon* and do not belong to *Cophura* in a strict sense.

The following key may be used supplementary to the key in Williston's Manual, or to Back's key. The genus *Comantella* will be readily distinguished from *Cophura* by the presence of a thoracic mane.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa, Ont.

1. Anterior tibiae with a twisted apical spine on the inner side; middle tibiae with a stout, straight black spine on inner side ..... *Comantella* n. g.
   Anterior tibiae without such spine; middle tibiae without strongly differentiated apical spine 2
2. Third antennal joint widest basally, usually slightly tapering, the style half or more as long as third antennal joint. Third longitudinal vein branched basad of the discal crossvein; wings with clouds on all crossveins and furcations; usually smaller species, with less tapering abdomen ..... *Eucyrtopogon* n. g.
   Third antennal joint usually coarctate, its base swollen, widest at or near the middle; third longitudinal vein branching distinctly beyond the discal crossvein; wings never so distinctly clouded on crossveins, but sometimes with one or two large blotches; usually large, with more acute abdomen ..... *Cyrtopogon* Lw.

Comantella new genus

In his monograph of the Dasypogoninae, Back placed the species *cristata* Coq. and *fallei* Back, in the genus *Cophura*, at the same time noting that the genus as understood by him seemed to be a conglomeration of species, several of which showed no relationship. Comparing the species before me with Osten Sacken's description of the genus *Cophura*, I find that they cannot be included in that genus, and therefore propose the name *Comantella* for *Cyrtopogon maculosa Coq.*, (type) and *Blacodes cristatus* Coq.

The genus is very similar to *Eucyrtopogon* and is distinguished from it by the presence of a curved spur at the apex of the front tibia. All other characters are practically the same. Were it not for the fact that the species will not trace out to *Cyrtopogon* in any tables of genera I should consider the presence of the spur of little value and should include the group under the genus *Eucyrtopogon*. The spur is rather weak and often difficult to see, and this resulted in Coquillett describing *maculosa* as *Cyrtopogon* and the redescription of the same species as *Cophura fallei* by Back. The two known species possess a remarkable condensation of hair on the thorax, forming a distinct mane, a character also possessed by *E. comantis*.

Only *C. maculosa* is known to occur in Canada. The two species may be distinguished by the following synopsis:

Margin of scutellum with only four bristles ..... *cristata* Coq.
Margin of scutellum with numerous bristles (*fallei* Back) ..*maculosa* Coq.

Comantella maculosa Coquillett

Thorax with a distinct black mane; front tibiae with curved apical spur: scutellum with about twelve apical bristles.

Length, 9 to 12 mm. *Male*. Face moderately gibbose, most prominent at the middle, convexly retreating below, gently convex above, the swelling not quite reaching the base of the antennae; silvery white pollinose; mystax composed of rather coarse black hairs, their tips white. Front with similar pollen; only a small, black spot immediately above the antennae; on the sides with a few long black hairs, with many stouter, longer hairs on ocellar tubercle, their tips white. Occiput silvery white pollinose, fine white pilose, except for

a row of stout, brownish or yellow hairs above. Antennae black, thinly yellow pollinose; white pilose, the first joint with one, the second with two long black hairs below; first joint slightly longer than broad, "barrel-shaped," widest in middle, second joint slightly longer than broad, more slender than the first, and about three-fourths as long; third joint one-third longer than first two combined, broadest basally, gradually tapering on apical two-thirds, the style half as long as third joint, moderately broad, with nearly parallel sides, its spine short.

Thorax shining black in ground color, but everywhere pollinose, less thickly so on the pleura, especially below. Mesonotum sub-carinate, very high, the sloping sides very little convex, the middle forming a prominent rounded ridge which is yellowish pollinose on the middle line, and blackish on either side, the slopes greyish pollinose, with a small, darker area contiguous to the dark middle stripe between the humeri, a broad, elongate spot, widest anteriorly on the middle half, about half way between the middle and side margins, and the postalar calli brown pollinose or blackish in some lights. Pleura greyish pollinose with brown spots on meso- and sternopleura. Pile fine, rather sparse, long, white, the median crest long, black, with a few white hairs behind. Bristles black and yellowish. Sternopleura with only four or five white hairs above. Black hairs mostly white tipped. Scutellum convex, grey pollinose, its disc brownish yellow pollinose with fine white pile and eight to twelve long, black, apical bristles, one or two pairs of which may be whitish.

Legs wholly shining greenish black; the tibiae may have a narrow, more or less reddish stripe on the outer side basally; wholly white pilose, most of the hairs long, fine; bristles yellow, their apices white. Anterior tibiae with a twisted apical spine on inner side, middle tibiae with stout, black, apical spine on anterior apex.

Wings hyaline or slightly cinereous, the crossveins and furcations all clouded with brownish. The third longitudinal vein branches before the apical crossvein. Squamae whitish yellow, with white fringe. Halteres fuscous.

Abdomen shining blue black, the second segment about the basal third, just beyond a bare, flattened, polished band, and the bases of the two or three following segments, with a transverse greyish pollinose band, widest in the middle and very broadly separated from the sides. The lateral margins are wholly, broadly grey pollinose, the pollen expanded on the posterior angles to form small triangles, their anterior margin concave, the second segment except behind, more narrowly, more yellowish pollinose; seventh segment entirely pollinose or only the middle bare. Pile wholly white, moderately long, or sometimes yellowish on the disc.

Female. Style slightly longer, its basal section longer. Second antennal joint with three black bristles. Hairs of front sometimes largely whitish. Second abdominal segment apparently not pollinose laterally except posteriorly and the veins at the apex of the wing may be slightly clouded with greyish.

Redescribed from 2 ♂, 2 ♀ Penticton, B. C., April 4, 1919, (E. R. Buckell).

Specimens were compared with the type in the United States National Museum. The synonymy of *Cophura fallei* is given from comparison with description, which agrees perfectly.

Eucyrtopogon new genus

Allied to *Cyrtopogon*. Face gibbose. Third antennal joint longer than the first two combined, widest basally, gradually slightly tapering, its style half as long as third joint. Thorax convex, rarely with a prominent longitudinal ridge bearing a distinct mane, usually moderately pilose, with bristles on lateral margin; largely pollinose. Scutellum convex, with fine pile or moderately stout hair, usually with stronger apical hair or bristles. Legs not specialized, tibiae and tarsi with bristles, the former without a curved spine apically on the front pair. Abdomen of ♂ with sub-parallel sides, obtusely rounded apically; of ♀ distinctly broadest in the middle, beyond which it is tapering, the apices of the segments grey pollinose on posterior angles. Wings with the crossveins and furcations always clouded with brownish, the third vein (R_4 and R_5) branching basad of the discal crossvein (the outer vein of the discal cell). Genotype *Crytopogon nebulo* O. S.

TABLE OF SPECIES.

1. Males 2
   Females 6
2. Middle line of the thorax with a very conspicuous mane of white and black hairs ..... *comantis* n. sp.
   No condensation of pile to form a mane. 3
3. Costa with a double row of abundant, short, curved spines 4
   Costa without spinose hairs curved at right angles, the hairs much shorter; wings with two deep brown spots in first basal cell, the costa broadly brown on apical fourth ..... *varipennis* Coq.
4. The anterior apex of the hind coxae is produced forward as a conspicuous conical tubercle, lower fringe of curved hairs on costa as long as width of costal cell ..... *calcarata* n. sp.
   Hind coxae not with a conspicuous production, fringe of curved hairs not over three-quarters as long as width of costal cell 5
5. Sides of front with hoary bloom; mystax with the ends of the hairs silvery white ..... *diversipilosis* n. sp.
   Sides of front with brownish yellow bloom; mystax with ends of hairs yellow ..... *nebulo* O. S.
6. Seventh abdominal segment without sericeous pollen ..... *nebulo* O. S.
   Seventh abdominal segment with sericeous pollen 7
7. Mystax chiefly white, wings almost without villi ..... *albibarbis* n. sp.
   Mystax chiefly black, wings distinctly villous 8
8. The sericeous pollen on the sides of sixth abdominal segment reaches broadly almost or quite to the base of the segment ..... *calcarata* n. sp.
   The pollen does not extend over two-thirds the distance to the base, or only very narrowly so on the sides 9
9. Genitalia with 8 stout spines ..... *diversipilosis* n. sp.
   Genitalia with 10 or 12 stout spines ..... *spinigera* n. sp.

(to be continued)

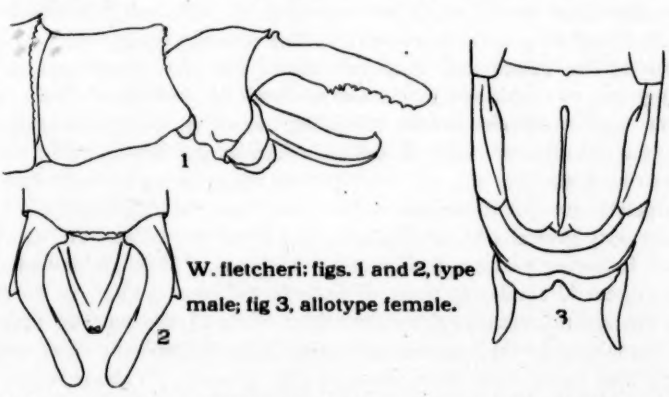
A NEW SPECIES OF WILLIAMSONIA (ODONATA-CORDULIINAE)

BY E. B. WILLIAMSON,
Bluffton, Ind.

Last August Dr. McDunnough kindly gave me a male and a female specimen of this genus collected near Ottawa, Canada. As I had heretofore seen only a single female of *W. lintneri*, studied years ago for Mr. Davis, and as Dr. Howe had promised me a specimen of that species, the specimens sent by Dr. McDunnough were set aside for later study. In October Dr. Howe kindly complied with his earlier promise and sent me a male of *lintneri* collected at West Roxbury, Massachusetts, May 6, 1922, by W. J. Clench. When the three specimens above enumerated were studied in connection with Hagen's description of *lintneri*, it was at one evident that two species were represented and that the Canadian specimens represented the undescribed species. I at once communicated this fact to Dr. McDunnough, who kindly sent me all the specimens of the genus in his charge, and later I obtained a female of *lintneri* for study from Dr. Howe. This female was taken at Rumford, Rhode Island, May 11, 1922 by E. D. Keith.

Williamsonia fletcheri new species.

Abdomen male 22.5—23.5, female 22—23; hind wing male 21.5—22.5, female 22—23; stigma front wing male 1.8, female 1.9—2.2; stigma hind wing male 2, female 2—2.4; hind femur 5; superior appendages male in lateral view 2, inferior appendage, 1.3; appendages female, 1.2; vulvar lamina, 1.8.



W. fletcheri: figs. 1 and 2, type male; fig 3, allotype female.

Male and female: Labium dull yellow; face and head above, including the occiput, dark to black, the anteclypeus somewhat paler and the frons with metallic bronze or greenish reflections; rear of head shining black.

Prothorax with front and hind lobes pale, yellowish; middle lobe black.

Thorax and legs black; thorax with a small, ill-defined gray area anterior to each antealar sinus and with ill-defined pale brown or gray areas on the pectus; dorsum of thorax duller than the sides, which are blacker with metallic reflections.

Abdomen and appendages black with restricted pale gray or yellowish markings as follows: a lateral inferior basal spot, anterior to the genital hamules

on 2; the integument between 2 and 3; a lateral inferior basal or subbasal spot on 3, reaching apically to midlength of the segment in the male and to the apex in the female; the integument between 3 and 4; in the male the merest vestige, on the extreme inferior border of the basal half of 4, of the homologue of the spot on 3; in the female the stripe on 4 is similar to the stripe on 3, but is reduced and does not quite reach the apex; integument between 4 and 5, almost as dark as the segments in the male, more distinctly pale in the female; 5 without markings in the male, in the female the homologue of the spot on 4 present but more reduced.

Wings hyaline, orange tinged at base, very reduced in the front wings; extending about half way to the first antenodal and to the cubito-anal cross-vein or slightly less in the hind wing, and more or less in the anal triangle along its basal vein, opposite the white or nearly white membranule, which is more or less grayish tinged in the male, especially posteriorly and along the inner border; veins black except the costa, which is yellowish to at least the nodus; stigma brown. Antenodals in front wing, 7 in five male and three female wings, 8 in four male and five female wings, and 10 in one male wing; antenodals in hind wing 4 in one female wing, 5 in eight male and six female wings, 6 in one female wing and 7 in two male wings; postnodals in front wing 5 in two male wings, 6 in three male and two female wings and 7 in five male and six female wings; postnodals in hind wing 5 in one male and one female wings, 6 in five male and one female wings, 7 in three male and five female wings and 8 in one male and one female wings; postanal cell in front wing one-celled in four male and three female wings, two-celled in six male and five female wings; subtriangle front wing free in every case but in one female wing where it is once crossed; one cubito-anal cross-vein in all the hind wings and in all the front wings but two male wings (in one of these the added cross-vein is proximal to the true cross-vein and in the other case it is distal and is under the arculus); anal triangle of male one-celled in four wings, two-celled in six wings. (Variations in venational characters of generic value have not been detected, so such characters are not discussed in the above specific description).

Accessory genitalia of male similar to that of *W. lintneri* and briefly described in a following paragraph discussing the genus. Male abdominal appendages also in general similar to those of *lintneri*, but more arcuate in dorsal view and with the ventral teeth on the apical three-fifths of the superior appendages larger. Female abdominal appendages more tapering apically, less uniformly cylindrical, and more acute than those of *W. lintneri*. Vulvar lamina black, longer than segment 9 in the middorsal line, nearly reaching the apex of the sternum of 9, divided for a distance of two-thirds to three-fourths its length, slightly but distinctly elevated, the posterior mesal angle of each lobe produced into a short triangular apex, which is directed meso-dorso-posteriorly. It is distinctly different from that of *lintneri* by its greater length, its slightly elevated position, and the triangular mesal apex of each lobe.

Described from six males and four females all from Mer Bleue, Ottawa, Ontario, Canada; May 25, 1908, and June 4, 1908, (two males, C. H. Young), May 23, 1922 (three males and four females, J. H. McDunnough) and May 29, 1922 (one male, A. W. Richardson), No. 555, in the Canadian National Col-

lection, Ottawa; the male of May 29 the type, and a female of May 23 the allotype. The types are at Ottawa, and some of the specimens above enumerated have been given by Dr. McDunnough to Drs. Walker and Howe and myself. At the suggestion of Dr. McDunnough, I take pleasure in naming this Canadian dragonfly for Dr. James Fletcher, "first Dominion Entomologist, who was a keen collector in all orders" and whose work is comparable with that of Dr. Lintner, for whom the species from the United States is named.

Fletcheri is a darker, denser veined species than *lintneri*, from which it is separated at once by the dark face and frons and the reduction or absence of pale apical markings on segments 2—9. In a letter Dr. McDunnough says. "This species is one of the earliest to occur in our locality and nearly all the specimens I took were more or less teneral and were taken in a small spruce grove close to a sphagnum bog, which contained several open pools of water, in which, I presume, the nymph lived. They seem to be fond of sitting on the trunks of the spruce trees, darting out from time to time to capture mosquitoes and other insects. When fully mature they are very difficult to catch, owing to their small size and the rough nature of the locality they frequent."

In addition to the venational characters hitherto used in defining this genus, the following characters may now be added: Tibial keel lacking in the female and on the midtibia of the male; on the fore tibia of the male the keel is about half the length of the tibia, and on the hind tibia it is equal to about two-thirds the length. Accessory genitalia of the male prominent, genital lobes oblong, hamules reaching to or beyond the apex of the genital lobes, scimitar-shaped with a curved indentation on the ventral border near mid-length; male superior abdominal appendages about as long as segment 8, shorter than 9 and 10 combined, roughly cylindrical, flattened basally with an externo-ventral toothed angle at about two-fifths the length, this angle followed by a row of seven to nine teeth, reaching the subapex, irregularly spaced and not uniform in size; inferior appendage triangular in shape, apex narrowly truncate, the length exceeding the width by one-fifth or slightly more, about two-thirds as long as the superiors. Vulvar lamina a large rounded triangular or oblong plate, nearly as long as or longer than segment 9 in the middorsal line, narrowly divided for more than half its length.

TWO NEW RACES OF THE GENUS PLEBEIUS LINN. FROM BRITISH COLUMBIA

BY E. H. BLACKMORE,
Victoria, B. C.

In a paper entitled "The Lycæninæ of British Columbia" (Proc. B. C. Ent. Soc., March, 1919, No. 14) the writer described a new race of *Plebeius saepiolus* Bdv. under the name of *insulanus*. In that paper I omitted to designate a type, but will do so now and append a more detailed description of this new race.

Plebeius saepiolus insulanus new race

Male. Upper side, bright silvery blue with a blackish border on outer margin, 1½ mm. wide on primaries, somewhat narrower on secondaries; fringes, basal third blackish, outer two-thirds white on outer margins, inner margins all

white. Underside both wings bluish-white sprinkled with green scales basally; subterminal row of spots on primaries are somewhat reduced, being rounder and not so elongate as in typical *saepiolus*, also in some specimens they have a tendency to become obsolete; on secondaries the subterminal spots are also round instead of being more or less triangular.

Female. Upper side, deep brown, with a narrow, somewhat indistinct black discal mark; secondaries with a few scattered bluish scales basally, on some specimens a trace of a reddish brown spot near anal angle. Fringes same as male. Underside similar to that of the ♂ excepting that the ground colour is darker, in some specimens deepening to brownish white.

The chief points of difference between this new race and typical *saepiolus* may be summed up as follows:—On the upper side in the ♂ the blue is much brighter and does not have the same light violaceous sheen as *saepiolus*, on the under-side the ground colour is a clear bluish white, not greyish white like the typical form.

In the female the colour of the upper side is an even dark brown with a few scattered blue scales basally, whereas typical *saepiolus* is heavily shot with blue on the basal half of both primaries and secondaries. Alar expanse 26—29 mm.

Described from 20 specimens, 10 ♂ ♂ and 10 ♀ ♀ taken by the writer at Victoria, B. C., and Goldstream, B. C.

Holotype—♂, Victoria, B. C., May 24th, 1916, in the Canadian National Collection at Ottawa.

Allotype—♀, Victoria, B. C., June 14th, 1916, in collection of author.

Paratypes—6 ♂ ♂ and 8 ♀ ♀, Victoria, B. C., May 22nd to June 24th; 3 ♂ ♂ and 1 ♀, Goldstream, B. C., May 30th to June 18th, in author's collection.

Paratypes will be distributed amongst the following institutions:—Canadian National Collection, Ottawa; U. S. National Museum, Washington, D. C.; Provincial Museum of Natural History, Victoria, B. C.; and the collection of Dr. Wm. Barnes.

Plebeius icariodes montis new race

Male. Upper side, pale violaceous blue with a narrow, black border (about 1 mm.) to outer margin of both wings; a short, narrow, black discal mark; fringes, on outer margins of both wings, basal half blackish, outer half white, inner margins all white. Underside of both wings pale greyish white; primaries with discal dash and post-median row of black spots heavily marked as in typical *icarioides*; subterminal spots much reduced, tending to become obsolete anteriorly; secondaries with a white lunate discal mark and a post-median row of white spots centered with a minute black dot excepting the first spot nearest costal margin, which contains a large, black dot; subterminal row of black spots faintly indicated; fringes white.

Female. Upper side deep brown, but not nearly so dark as in race *blackmorei* B. & McD,, basal half of primaries shot with violaceous blue; secondaries with a few blue scales at base and along inner margin; a subterminal indefinite line of bluish scales on outer margin, which breaks up to form a row of irregular lunules of the ground colour. Underside similar to that of the ♂, including the ground colour, which is rather unusual, as the underside of the females in

this genus is generally much darker than that of the males. Alar expanse 29 mm.

Described from 8 specimens, 6 ♂♂ and 2 ♀♀ from Mt. McLean, Mt. Cheam and the Hope Mts.

Holotype—♂, Mt. McLean, near Lillooet, B. C., (A. W. Hanham), July 15th, 1919, in Canadian National Collection, Ottawa, by the kind permission of the collector.

Allotype—♀, Mt. McLean (7,000 ft.) B. C., (A. W. Hanham), August 21st, 1920, in collection of author through the kindness of the collector.

Paratypes—3 ♂♂ and 1 ♀, Mt. McLean, B. C. (A. W. Hanham) July 14th, 1919 and August 21st, 1920; 1 ♂ Mt. Cheam, nr. Agassiz, B. C., August 7th, 1908; and 1 ♂, Hope Mts., B. C., (R. V. Harvey) July 17th, 1906, in the Hanham collection and that of the author. A male paratype will be sent to the U. S. National Museum and one to the Provincial Museum, Victoria, B. C.

This new race is evidently a high altitude form, and seems quite distinct. The specimens from Mt. Cheam and the Hope Mts. I have had separated for some years, and when I received Mr. Hanham's specimens from Mt. McLean, I became convinced that it was a good geographical race.

In the ♂ it differs on the upper side from *icarioides* Bdv. and *pembina* Edw. in the much lighter shade of violaceous blue and also in the much narrower black border; from *blackmorei* B. & McD. in the totally different shade of blue, the latter race being of a silvery blue; on the underside it differs in the much lighter ground colour from *icarioides* and *pembina*; in the spotting of the primaries it is not so heavy as either of the above-mentioned, but is much heavier than *blackmorei*. On the secondaries the black centres to the white spots are a little more distinct than in *blackmorei* while the large black centre to the anterior white spot of the post-median band seems quite distinctive. In fact, it seems a form that is midway between *pembina* on the one hand and *blackmorei* on the other, although the differentiating characters are apparently quite constant.

NOTICE

The attention of Entomologists throughout the world is called to the fact that, beginning with the Volume for 1922, the preparation of the "Insecta" part of the "Zoological Record," is being undertaken by the Imperial Bureau of Entomology. In order that the Record may be as complete as it is possible to make it, all authors of entomological papers, especially of systematic ones, are requested to send separata of their papers to the Bureau. These are particularly desired in cases where the original journal is one that is not primarily devoted to entomology. All separata should be addressed to:

The Assistant Director, Imperial Bureau of Entomology, 41, Queen's Gate, London, S.W.7, England.

Mailed Thursday, May 10th, 1923

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